

NON-PUBLIC?: N

ACCESSION #: 8904280281

LICENSEE EVENT REPORT (LER)

FACILITY NAME: Arkansas Nuclear One - Unit Two PAGE: 1 OF 4

DOCKET NUMBER: 05000368

TITLE: Reactor Trip Caused by Spurious Safety Injection Actuation Signal  
During Surveillance Testing of Engineered Safety Features Actuation  
System.

EVENT DATE: 12/01/88 LER #: 88-020-00 REPORT DATE: 04/24/89

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10  
CFR SECTION  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

NAME: Julie D. Jacks, Nuclear Safety and Licensing Specialist

TELEPHONE: 501-964-3100

COMPONENT FAILURE DESCRIPTION:

CAUSE: SYSTEM: COMPONENT: MANUFACTURER:

REPORTABLE TO NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

## ABSTRACT:

On December 1, 1988, at 0854 hours with the plant at 100 percent power, a reactor trip occurred when a spurious Safety Inject

on Actuation

Signal/Containment Cooling Actuation Signal (SIAS/CCAS) was generated during

surveillance testing of the Engineered Safety Feature Actuation system. As designed, the SIAS interrupted power to the two 4160V AC non-vital buses 2A1 and 2A2, which resulted in a momentary loss of power to the Control Element Drive Mechanism cabinets and a subsequent reactor trip on calculated low DNBR

(departure from nucleate boiling ratio). All components actuated by the SIAS/CCAS performed as designed. The momentary loss of power to 2A1 and 2A2

resulted in loss of various secondary system components, including the main feedwater pumps and the Steam Dump and Bypass Control System (SDBCS). An

Emergency Feedwater Actuation Signal automatically started pump 2P7A on low steam generator water level, and the steam pressure in the steam generators was controlled by the Main Steam Safety Valves (MSSVs) for a short period of time. Primary system post-trip response was normal except for slightly elevated pressure and temperature due to steam generator pressure being controlled by MSSVs instead of SDBCS. The plant was stabilized in Mode 3. A root cause for the inadvertent actuation could not be determined in subsequent investigations. A similar event was reported Licensee Event Report 368/85-014-00.

END OF ABSTRACT

#### A. Plant Status

At the time of this event, Arkansas Nuclear One - Unit 2 (ANO-2) was operating at 100 percent of full power with a Reactor Coolant System (RCS) (AB) average temperature of 580 degrees Fahrenheit and pressurizer pressure at 2250 psia.

#### B. Event Description

On December 1, 1988, at 0854 hours, a reactor trip was caused by a spurious Safety Injection Actuation Signal (SIAS) and Containment Cooling Actuation Signal (CCAS) during routine monthly surveillance testing of the Engineered Safety Features Actuation System (ESFAS) (JE). Instrumentation and Control (I&C) technicians had just initiated testing of the SIAS "AB" matrix relay for ESFAS channel 4 when an SIAS/CCAS was generated on channels 3 and 4, resulting in full SIAS/CCAS actuation.

As designed, the SIAS opened the normal power supply feeder breakers from the unit auxiliary transformer to 4160V AC non-vital buses 2A1 and 2A2 (EA). This resulted in a loss of power and coastdown of the Control Element Drive Mechanism (CEDM) motor-generator sets, which caused deenergization of the Control Element Assemblies (CEAs). Approximately 3 seconds after the deenergization of 2A1 and 2A2, the CEAs began dropping into the core, and the Reactor Protection System (RPS) (JC) generated a reactor trip signal on a calculated low DNBR (departure from nucleate boiling ratio) due to the CEA positions. The DNBR trip occurred approximately 4 seconds after the spurious SIAS/CCAS. The main turbine

generator had apparently already tripped at this time due to a loss of control power caused by deenergizing buses 2A1 and 2A2.

Buses 2A1 and 2A2 supply the vital 4160V AC buses 2A3 and 2A4, respectively. Deenergization of 2A1 and 2A2 caused a momentary loss of the power to the vital buses and their associated vital 480V AC buses. The SIAS had also initiated an automatic start of both Emergency Diesel Generators (EDGs) (DG), which are designed to supply 2A3 and 2A4 on a loss of power within 15 seconds of starting. However, a main generator lockout initiated as a result of the turbine trip caused an automatic transfer and reenergization of buses 2A1 and 2A2 from startup transformer number three, an off-site power supply source, within approximately 1.4 seconds after the turbine tripped. Thus, vital buses 2A3 and 2A4 were reenergized from 2A1 and 2A2 before the EDG feeder breakers to 2A3 and 2A4 were required to close.

The plant response the SIAS/CCAS was as designed. Besides starting both EDGs, the SIAS/CCAS also initiated various component actuations and system alignments as designed, such as starting High Pressure Safety Injection (HPSI) (BQ) pumps, and low Pressure Safety Injection pumps. The pumps did not inject water into the RCS because RCS pressure did not drop below the pumps shutoff head during the transient. The brief loss of power to non-vital 2A1 and 2A2 also caused the loss of several major secondary components, such as the main feedwater pumps (SJ-P), the condensate pumps, the heater drain pumps, and the 480V AC support systems for these components. The Steam Dump and Bypass Control System (SDBCS) was deenergized and steam generator (SG) pressure was controlled by the Main Steam Safety Valves (MSSVs) (SB-RV) until the SDBCS was reenergized and reset, allowing use of the main turbine bypass valves and main condenser for dumping steam and decay heat removal. The MSSVs maintained

by the SDBCS. This resulted in a slightly elevated post-trip TCS pressure and temperature.

Approximately 12 seconds after the SIAS, an Emergency Feedwater Actuation Signal (EFAS) on low steam generator water level (less than 23 percent narrow range) was initiated due to normal post-trip water level response and the 'A' Emergency Feedwater (EFW) pump, 2P7A, (BA-P) automatically started. A few seconds later Operators manually started 2P7B, and the 'B' EFW pump, and SG water levels were restored and maintained by the EFW system.

At 0911 hours, I&C technicians reset the SIAS, and operators then began securing SIAS/CCAS actuated components in accordance with the Emergency Operating Procedure. The plant was stabilized in Mode 3 hot standby.

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Each main steam header is equipped with five MSSVs. One safety valve per header is required to have a lift setpoint of 1078 psig 1 percent, two per header at 1105 psig 1 percent, and two per header at 1132 psig 1 percent. During evaluations conducted following the transient, operations personnel commented that two of the MSSVs (mid-range) appeared to be opening prior to two other MSSVs which should have lower setpoints. This could not be conclusively verified and the SG pressure was still being maintained at an acceptable post- trip value.

### C. Safety Significance

Even though the inadvertent SIAS signal caused a momentary loss of power to the non-vital and vital 4160V AC electrical buses resulting in a

reactor trip and the loss of various secondary plant systems. The effect of this event on the post-trip primary system response was minimal. Decay heat removal was adequately maintained utilizing the EFW system and MSSVs until restoration of the post trip values due to the loss of the SDBCS and the subsequent control of SG pressure by MSSVs. The inadvertent actuations of safety equipment (e.g., HPSI pumps, LPSI pumps, valves, etc.) did not significantly affect the capability of the Operations staff to respond to the transient. The plant was safely stabilized in Mode 3, Hot Standby.

#### D. Root Cause

A work plan was developed and performed which checked power supplies to ESFAS relay hold coils, performed transistor checks, and repeated pertinent sections of the surveillance procedure which was in progress at the time the inadvertent actuation signals were initiated. No equipment malfunctions were found, and the inadvertent SIAS/CCAS could not be duplicated during the troubleshooting. No root cause for the spurious actuation could be determined.

#### E. Basis for Reportability

This event included automatic actuations of ESF and RPS and is therefore reportable under 10CFR50.72(a)(2)(iv).

A four-hour report to the NRC Operations Center was made concerning this event in accordance with 10CFR50.72(b)(2)(ii) at 0923 hours on December 1, 1988.

#### F. Corrective Actions

Since investigation of the spurious SIAS/CCAS did not determine the cause, no further corrective action could be performed. The surveillance procedure instructions were reviewed for possible contributing factors (i.e., potential human factors problems) and none were found.

Verification of the MSSV lift setpoints was performed during a plant shutdown performed in January 1989. Six of the ten safety valves were determined to be lifting at the setpoints slightly outside of the specified range for the valve, including the two low range safeties and the two midrange safeties which appeared to lift prematurely after the trip December 1988. The lift setpoints for the two midrange safeties were found to be near the setpoint of the low range valves. The safety valves were adjusted and the as-left lift setpoints were within the required ranges.

Following a previous similar event which occurred on July 18, 1985, actions were initiated to evaluate the feasibility of modifying or deleting the ESFAS design which incorporates a direct trip of the unit auxiliary transformer power supply breakers to the non-vital 4160V AC electrical buses whenever a SIAS is initiated. These evaluations have been completed and a plant design change developed to delete this design feature. This modification should significantly improve change developed to delete this design feature. This modification should significantly improve the capability to cope with the consequences of inadvertent actuation signals should they occur. The modification is currently scheduled to be implemented during the next ANO-2 refueling outage.

G. Additional Information

A previous reactor trip caused by an inadvertent SIAS during surveillance testing was reported in Licensee Event Report 368/85-014-00.

Energy Industry Identification System (EIIIS) codes are identified in the text in brackets (xx)

ATTACHMENT 1 TO 8904280281 PAGE 1 OF 1

AP&L

ARKANSAS POWER & LIGHT COMPANY

April 24, 1989

2CAN048902

U.S. Nuclear Regulatory Commission

Document Control Desk

Mail Station P1-137

Washington, D.C. 20555

SUBJECT: Arkansas Nuclear One - Unit 2

Docket No. 50-368

License No. NPF-6

Licensing Event Report No. 50-368/88-020-00

Gentlemen:

In accordance with 10CFR50.73(a)(2)(iv), attached is the subject report concerning a reactor trip which was initiated by a spurious Safety Injection



Actuation Signal which occurred during surveillance testing of the Engineered Safety Features Actuation System.

Very truly yours,

J. M. Levine  
Executive Director,  
Nuclear Operations

JML:JDJ:vgh  
attachment

cc w/att: Regional Administrator  
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U. S. Nuclear Regulatory Commission  
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INPO Records Center  
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MEMBER MIDDLE SOUTH UTILITIES SYSTEM

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